

Air Force Civil Engineer Center



FORMER
WILLIAMS AIR FORCE BASE

**Site LF004 Landfill
Remedial Action**

**BCT Conference Call
21 November 2019**



LF004 Recent and Upcoming Activities

- Draft 2018 annual landfill inspection report under regulatory review since 17 Jun 2019
- Annual landfill inspection completed 23 Oct 2019
- Planning in progress for decommissioning of SVE and IWAS treatment systems
- Semi-annual PDB sampling ongoing

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Site FT002
Fire Training Area Remedial
Action

BCT Conference Call
21 November 2019



Site FT002 Update

- AF approved keeping the DEUR in place Nov 2018
- AF will prepare Explanation of Significant Differences (ESD) document to add the land use control to the ROD
- Responses to EPA and ADEQ comments on Remedial Action Completion Report and revised Report being prepared for submittal
- If necessary, a technical conference call with regulatory agencies to resolve comments can be scheduled

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**FORMER
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Site SS017
Old Pesticide/Paint Shop**

**BCT Conference Call
21 November 2019**



Site SS017 Groundwater Monitoring Update Path Forward

- Q3 (Aug) 2018 data summary report submitted 12 Apr 2019 is under regulatory review
- Annual (Nov) 2018 groundwater report submitted 18 Apr 2019. Reissued hard copy reports on 30 Apr 2019. Report is under regulatory review.
- Q2 (Jun) 2019 data summary report under AF review
- Q3 (Aug) 2019 data summary report under AF review
- Q4 (Nov) 2019 sampling and land use control inspection in progress



Parcel K-1-2 Property Transfer

- Draft final FOST and SEBS including RTC to ADEQ comments posted for public comment. Comment period end 25 Mar 2019; no comments received.
- EPA comments received 11 Mar 2019
- Draft final FOST and SEBS issued to ASU for coordination
- FOST (final version in track changes responding to EPA comments) was issued via email for regulatory concurrence 24 Jul 2019 with follow up email 9 Aug 2019
- FOST clean copy with all revisions, responses to comment and ADEQ requested changes issued 15 Oct 2019
- Final FOST to be routed for AF signature after regulatory concurrence
- Draft DEUR and assignment package to be prepared

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***FORMER
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**Site ST035
Former Building 760**

**BCT Conference Call
21 November 2019**



ST035 Update

- **SVE system and enclosure decommissioning completed in July. ASU has indicated that the concrete pad, walls, and fencing will be retained for use by facilities management.**
- **Well abandonment activities complete on 22 Oct 2019. Documentation of well abandonment in preparation.**

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Partial Deletion

BCT Conference Call
21 November 2019



PARTIAL DELETION UPDATE

- Draft table and figure submitted for regulatory review on 29 Sep 2014
- Comments received by ADEQ during Sep 2014 BCT meeting addressed in follow on email. No comments received from EPA.
- Deletion on hold during SS017 and ST012 informal disputes
- Final deletion tables and figure ready for submittal and provided to BCT in April 2019 BCT meeting
- NOPD submittal for EPA/ADEQ scheduled for Nov 2019

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**FORMER
WILLIAMS AIR FORCE BASE
Site ST012
Former Liquid Fuel
Storage Area**

**BCT Conference Call
21 November 2019**



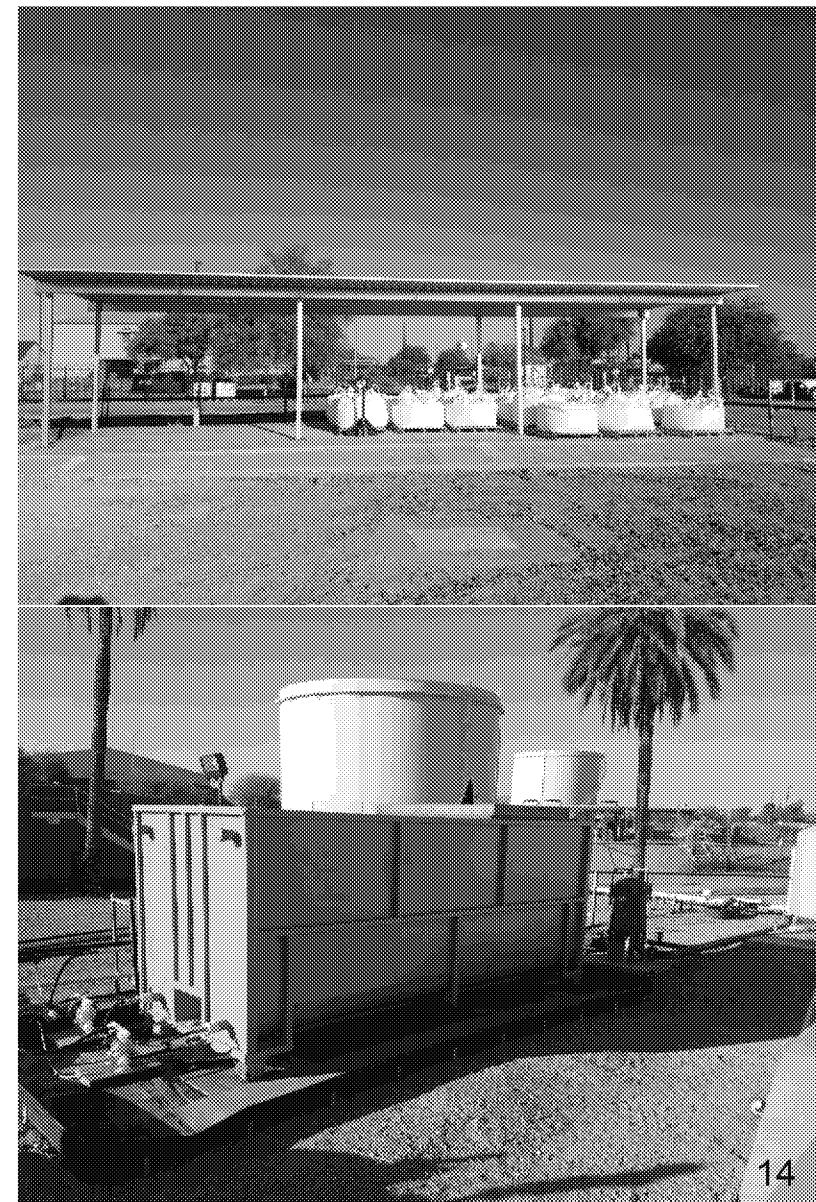
Site ST012 Outline

- Summary of activities since Oct BCT call
- Update on SVE system (JP-4 equivalent of methane)
- LNAPL removal update
- Updated on benzene and sulfate concentrations
- Evaluation of potential biological testing locations
- Pilot study extraction/injection update
- Path forward



Site ST012 Activities Since Sep

- Continued SVE operation
- LNAPL screening in select wells
- Operation of Extraction and Treatment
 - Pump Maintenance
 - Well pumps in CZ21 and LSZ43 repaired
 - Extraction pumps in UWBZ21 and UWBZ30 cleaned and reinstalled (pneumatic)
 - Recent electrical issues on CZ21, UWBZ25, LSZ23, and LSZ43 (driller being scheduled)
 - Evaluating pump options for potential extraction at W36 during subphase 4
 - Shut down extraction at LSZ37
 - LSZ37 pumping rate was declining
 - LSZ37 shut down based on increasing sulfate
 - Pump pulled and biological fouling apparent at LSZ37
 - Treated Water Storage Tank
 - Moved a ~10,000 gallon HDPE tank from former SEE operations for treated water storage to reduce fill times for mixing sodium sulfate batches.
 - Piping connections (plumbing) in progress .
- Sodium sulfate injections (detail on later slides)

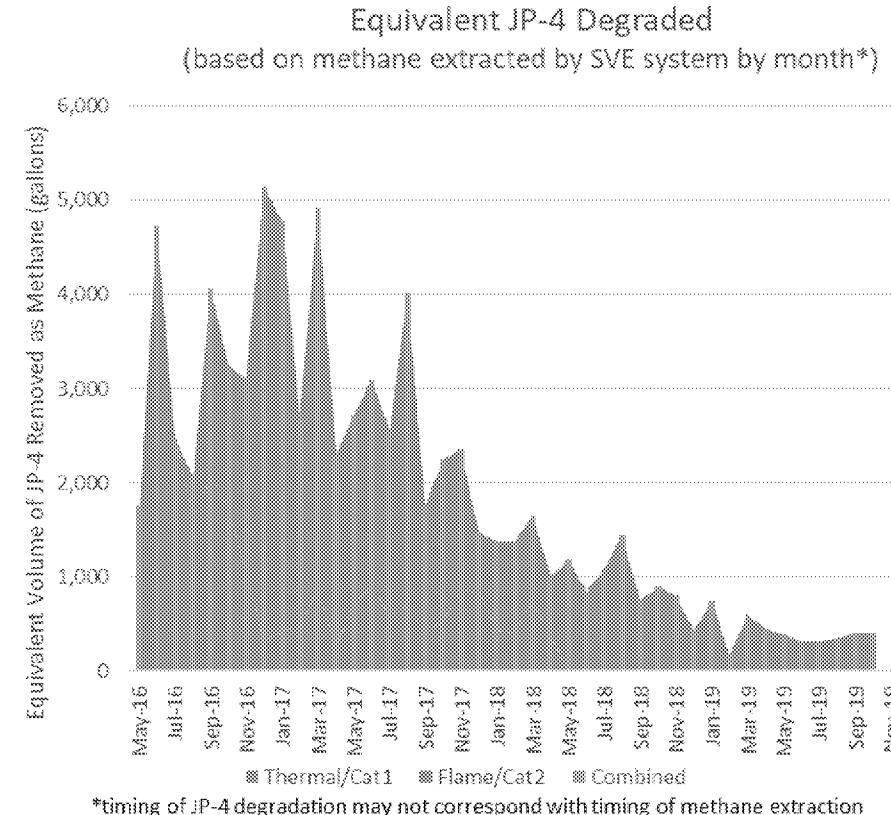
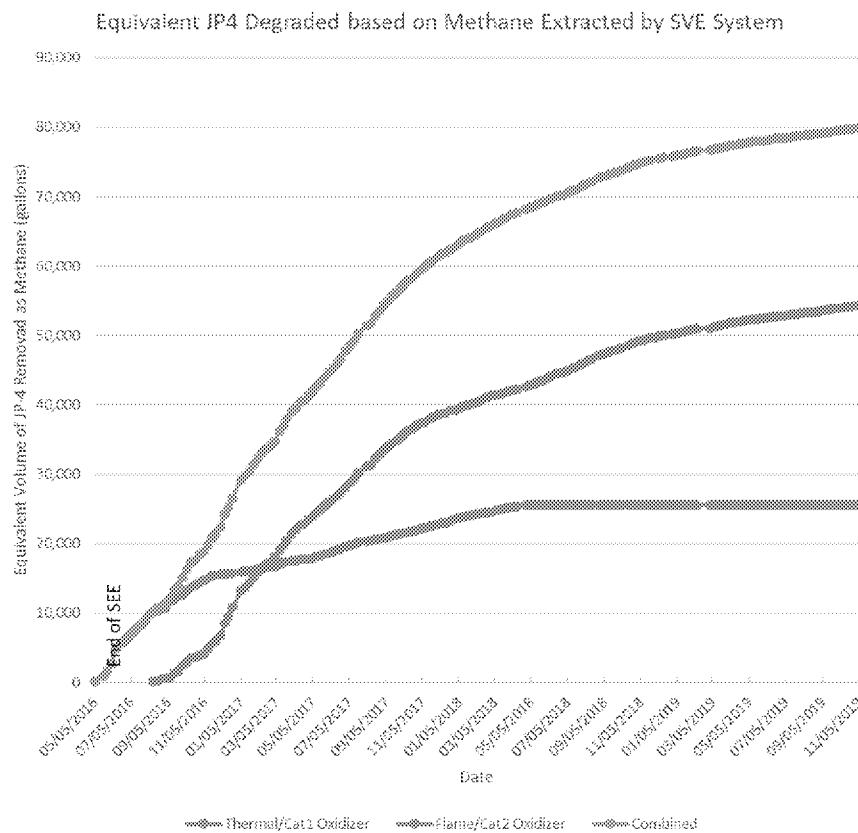




JP-4 Degradation Based on Methane Removed with SVE



Site ST012 SVE System Equivalent JP-4 Degradation Based on Methane Removed



- Estimates through 31 Oct 2019
- Estimated JP-4 degradation as methane is in addition to JP-4 removal reported for SVE
- Thermal/Cat1 oxidizer changed from SVE to groundwater treatment end of Apr (low methane concentrations recently observed but attributed to vapor bleed through closed valve from SVE)
- Flame oxidizer treating combined SVE and air stripper intermittently in Nov 2018 – Jan 2019
- Flame oxidizer replaced by catalytic oxidizer (Cat2) 7 Feb to 26 Feb 2019

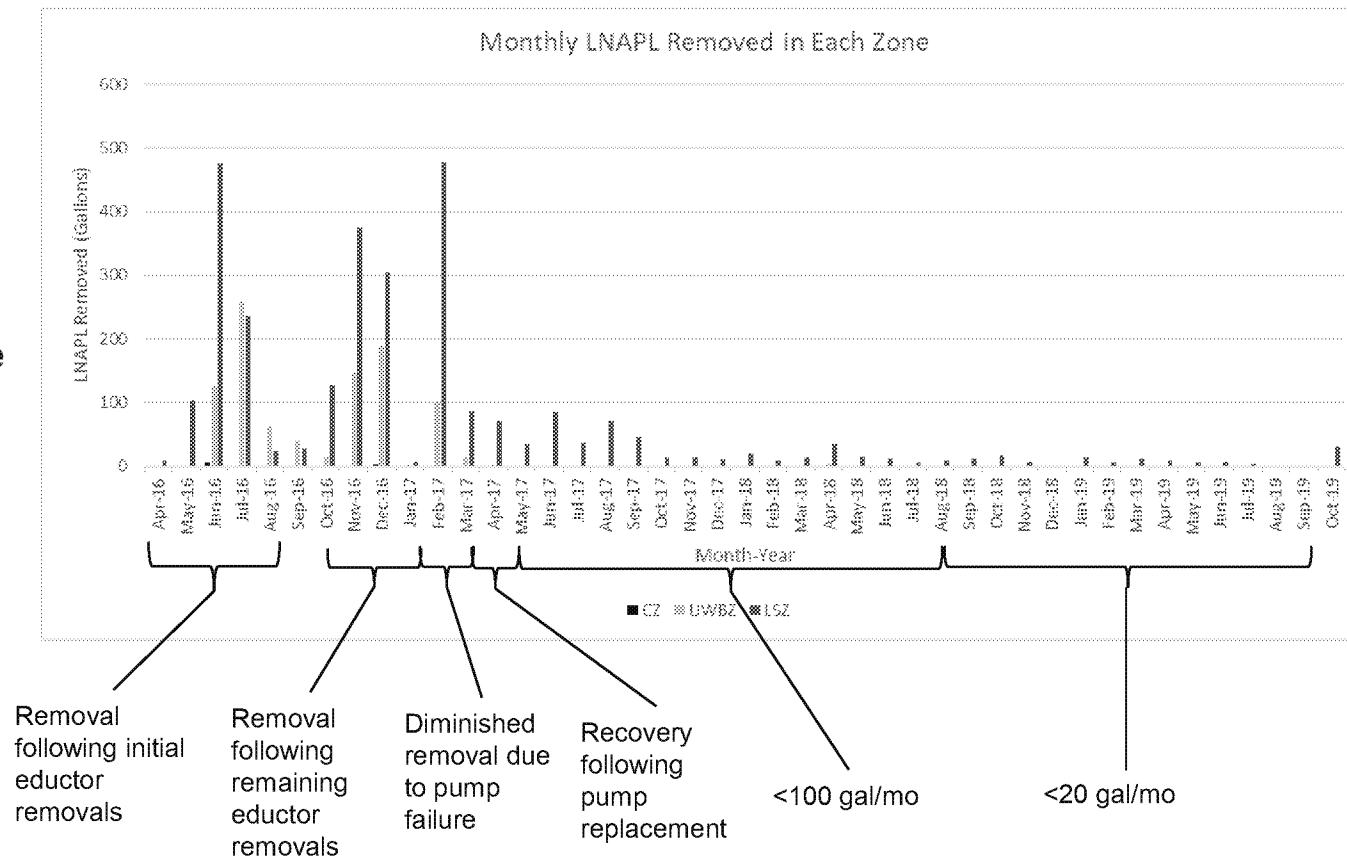


LNAPL Removal Update (through 08 Nov)



ST012 LNAPL Removal Summary

- CZ – 7 gallons of LNAPL removed. None since Nov 2016
- UWBZ - 963 gallons of LNAPL removed. None since Apr update.
- LSZ - 2,874 gallons of LNAPL removed. 30 Gallons removed since Oct update. (LSZ43)





Preliminary Fourth Quarter Groundwater Sampling Results



Sampling Summary

- **Sampling included:**

- Extraction Wells
- Injection Wells (where injections took place)
- Monitoring Wells (in areas where injections took place)
- Perimeter Wells

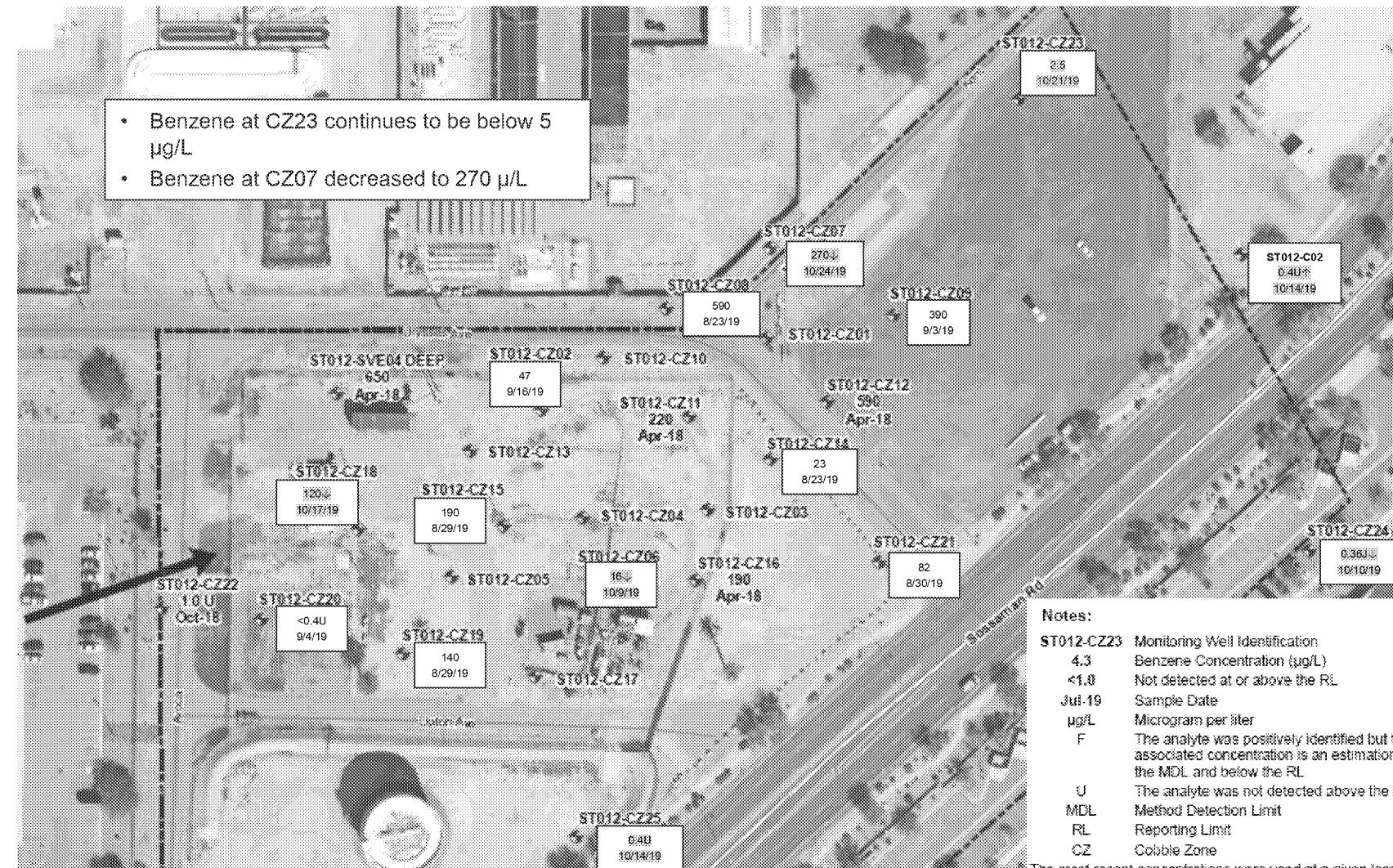
- **General Observations**

- Benzene at CZ23 continues to be below 5 µg/L
- Benzene at CZ07 decreased to 270 µg/L
- Benzene at perimeter well UWBZ38 decreased to 0.41 µg/L



Site ST012 Benzene (µg/L) in CZ

- Benzene at CZ23 continues to be below 5 µg/L.
- Benzene at CZ07 decreased to 270 µL.



Notes:

ST012-CZ23	Monitoring Well Identification
4.3	Benzene Concentration (µg/L)
<1.0	Not detected at or above the RL
Jul-19	Sample Date
µg/L	Microgram per liter
F	The analyte was positively identified but the associated concentration is an estimation above the MDL and below the RL
U	The analyte was not detected above the RL
MDL	Method Detection Limit
RL	Reporting Limit
CZ	Cobble Zone

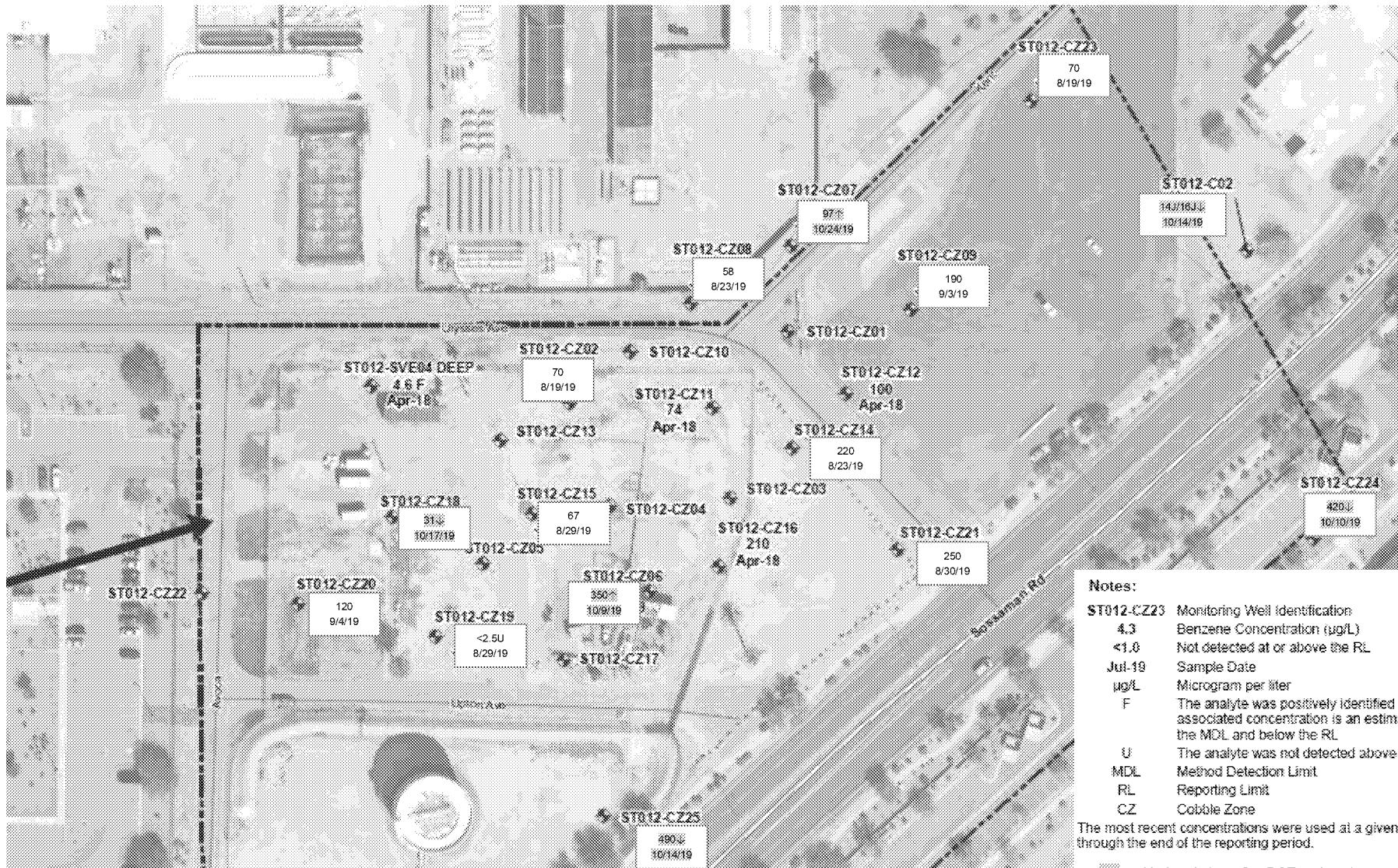
The most recent concentrations were used at a given location through the end of the reporting period.



Updated since Oct BCT update (arrow indicates direction of change from previous result)



Site ST012 Sulfate (mg/L) in CZ

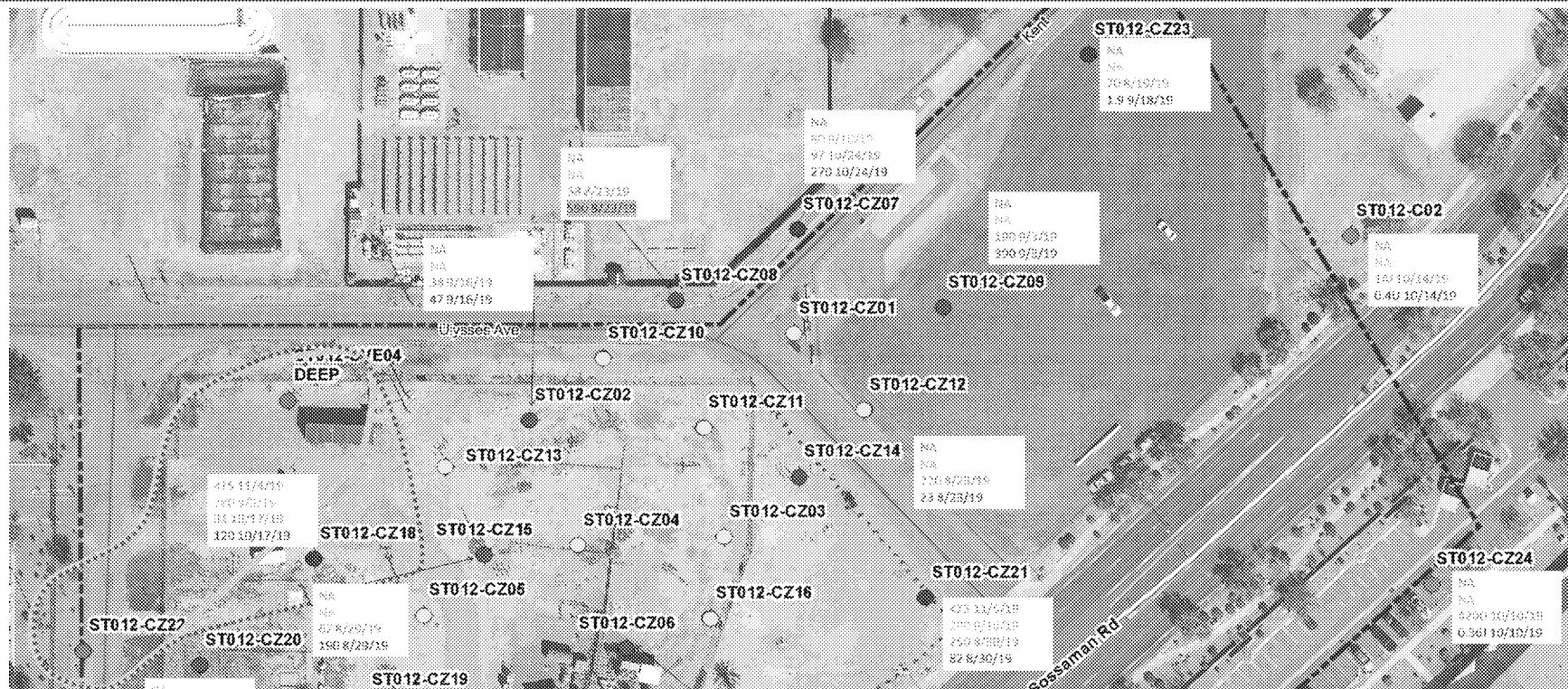


Updated since Oct BCT update (arrow indicates direction of change from previous result)

ED_005025_00010607-00022



EBR Treatment Area in CZ



- C02 and CZ20 previously tested for degrader populations by qPCR
- CZ18 sulfate concentrations went down
- Recently conducted screening test (BART) in two locations (CZ18 and CZ21). Results were low <75 cfu/ml.
- Consider sulfate injections in CZ10 to target highest concentrations in CZ07/CZ08/CZ09 area

Legend

- Groundwater Monitoring Well Location Screened in the CZ
- ST012 Site Boundary
- Extraction Well
- Inactive Extraction Well
- Injection Well
- Groundwater Monitoring Well
- Perimeter Groundwater Monitoring Well
- All Other Wells
- Bart Results (cfu/ml)
- Feed Sulfate Concentrations (mg/L)
- Lab Sulfate Concentrations (mg/L)
- Benzene Concentrations (ug/L)
- Benzene Concentration greater than 500ug/L

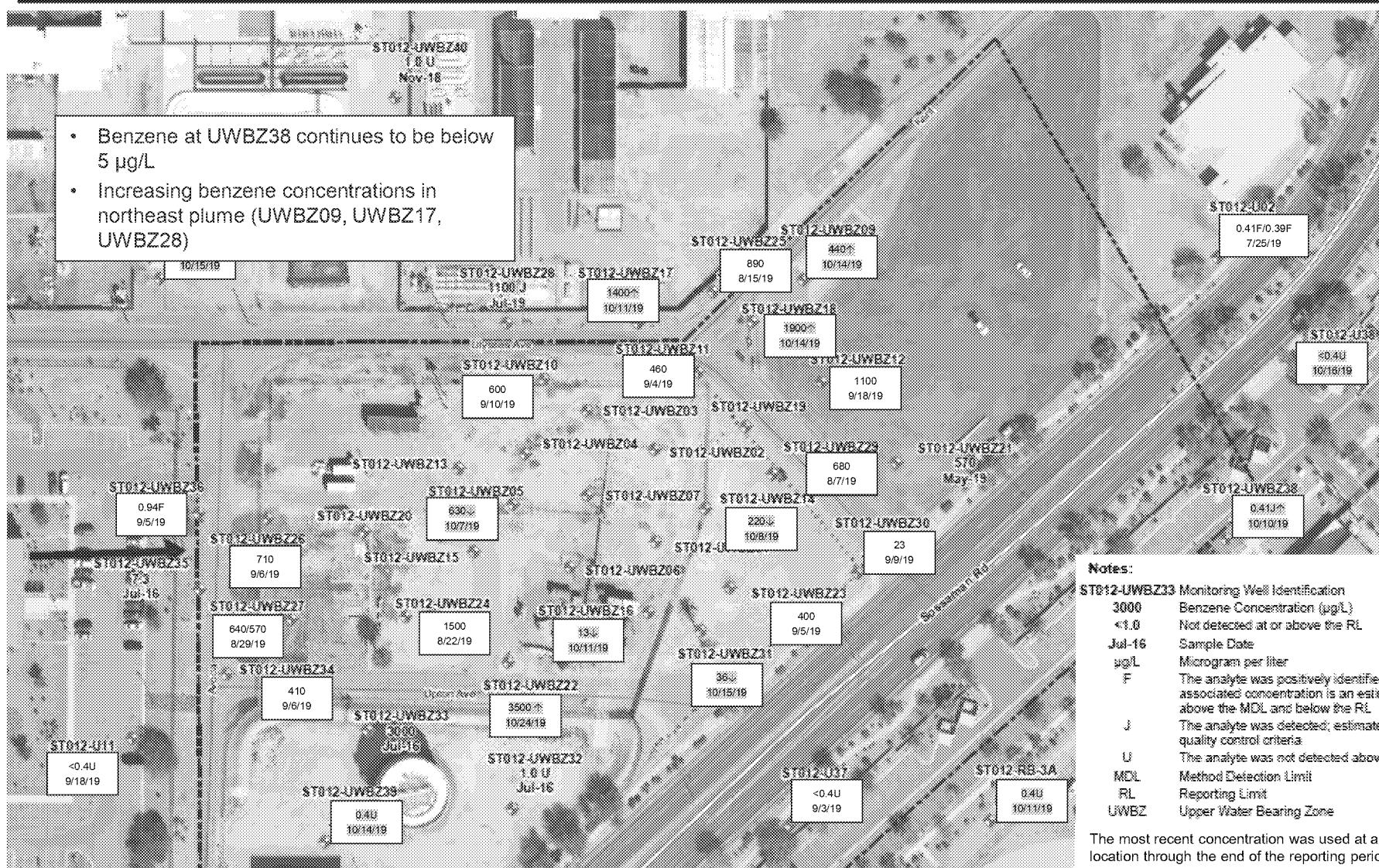
- Sulfate Concentration:
- Area of sulfate distribution by injections (generally indicated by injection locations and measure sulfate concentrations greater than 500 mg/L)
 - Previous area of sulfate distribution from Oct BCT update
 - D Sample was diluted for analysis
 - U The compound was analyzed for but not detected above the reporting limit.
 - F The analyte was detected, estimated above the method detection limit and below the reporting limit.

Notes:

- ST012-CZ23 Monitoring Well Identification
CZ Cobble Zone



Site ST012 Benzene ($\mu\text{g/L}$) in UWBZ



Notes:

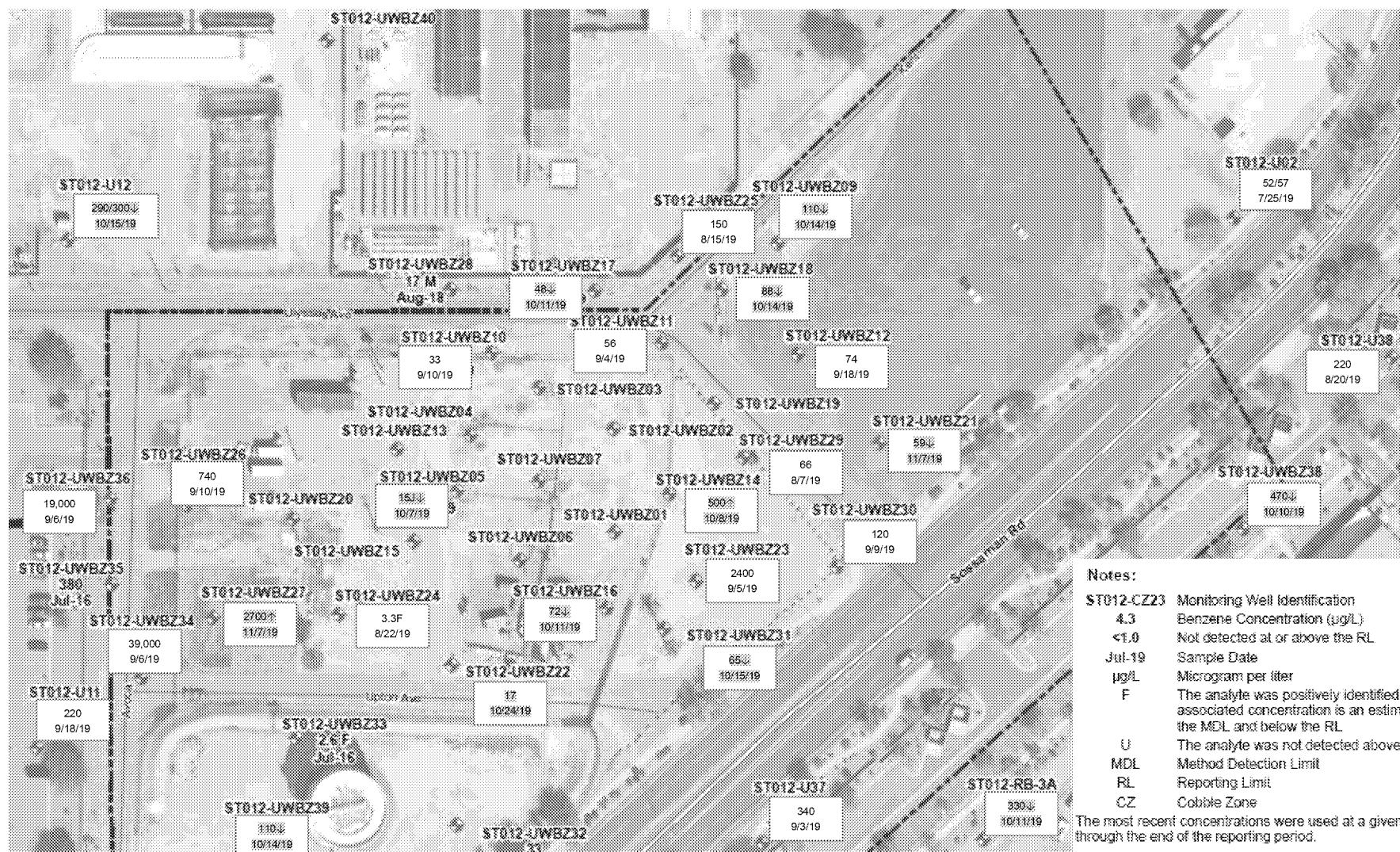
ST012-UWBZ33	Monitoring Well Identification
3000	Benzene Concentration ($\mu\text{g/L}$)
<1.0	Not detected at or above the RL
Jul-16	Sample Date
ug/L	Microgram per liter
F	The analyte was positively identified but the associated concentration is an estimation above the MDL and below the RL.
J	The analyte was detected; estimated due to quality control criteria.
U	The analyte was not detected above the RL.
MDL	Method Detection Limit
RL	Reporting Limit
UWBZ	Upper Water Bearing Zone

The most recent concentration was used at a given location through the end of the reporting period.

■ Updated since Oct BCT update (arrow indicates direction of change from previous result)



Site ST012 Sulfate (mg/L) in UWBZ



Notes:

- ST012-CZ23 Monitoring Well Identification
 - 4.3 Benzene Concentration (µg/L)
 - <1.0 Not detected at or above the RL
 - Jul-19 Sample Date
 - µg/L Microgram per liter
 - F The analyte was positively identified but the associated concentration is an estimation above the MDL and below the RL
 - U The analyte was not detected above the RL
 - MDL Method Detection Limit
 - RL Reporting Limit
 - CZ Cobble Zone
- The most recent concentrations were used at a given location through the end of the reporting period.

Updated since Oct BCT update (arrow indicates direction of change from previous result)



EBR Treatment Areas in UWBZ

Area of sulfate distribution by injection: generally defined by injection breakers and measure sulfate concentrations greater than 500 mg/L.
Previous area of sulfate distribution from Oct-BCT update

Data Quality Definitions:

✓ The compound was analyzed for but not detected above the reporting limit.

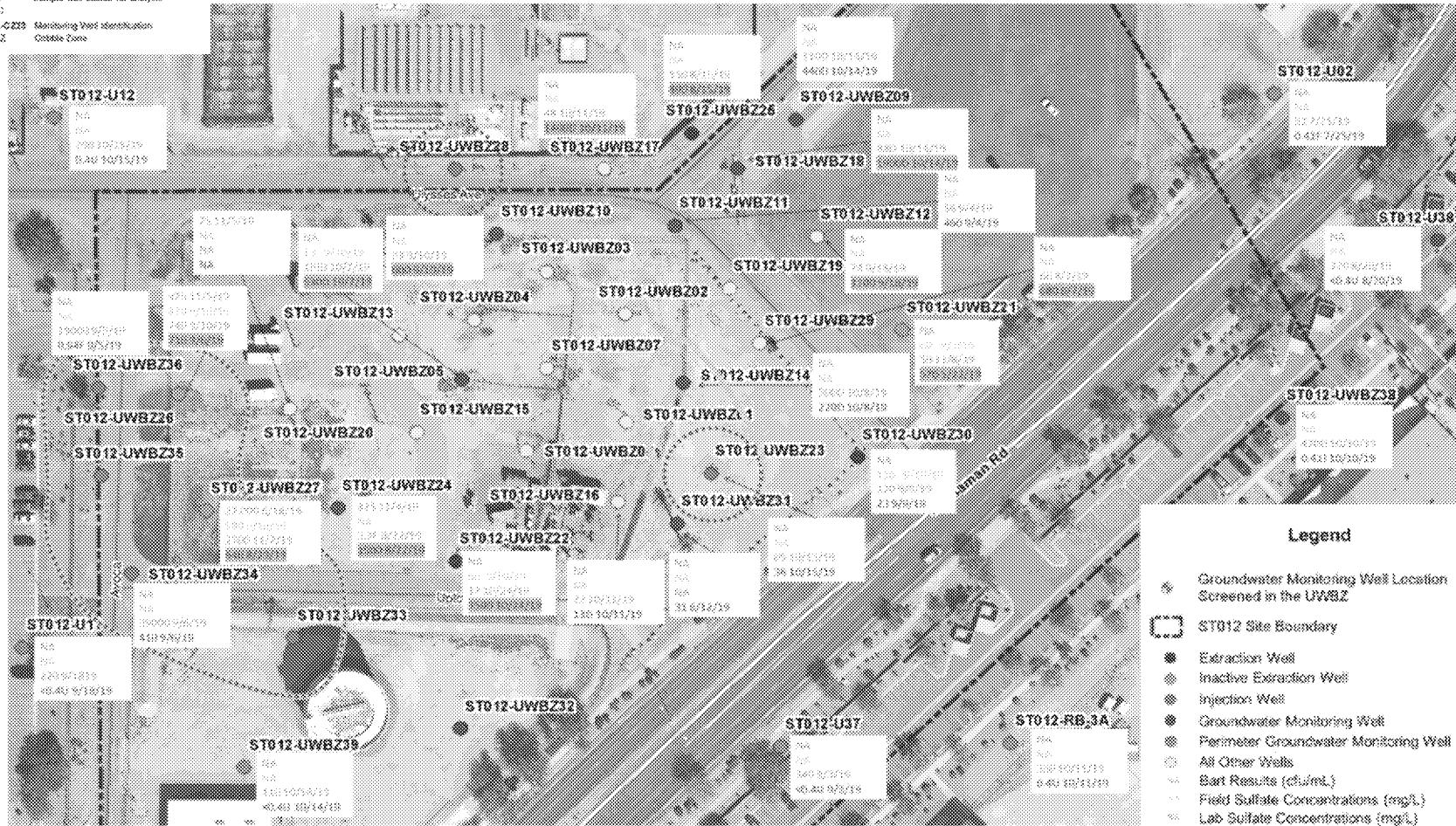
✗ The results were detected, estimated above the method detection limit and before the reporting limit.

D Sample was diluted for analysis.

Notes:

ST012-U220 Monitoring Well identification
Cable Date

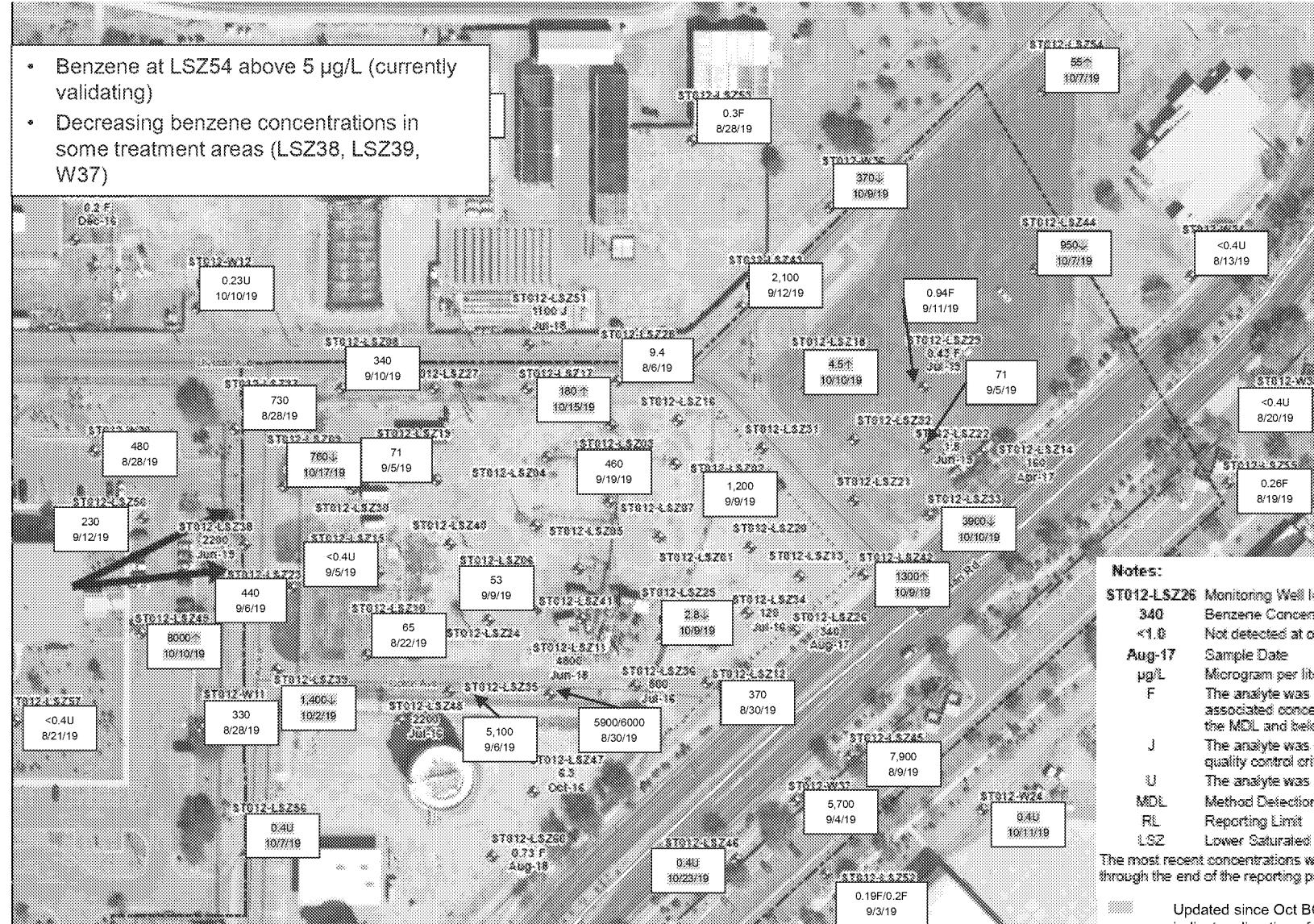
- UWBZ24 and UWBZ31 previously tested for degrader populations by qPCR
- Recently conducted screening test (BART) in three locations (UWBZ20, UWBZ24, and UWBZ26).





Site ST012 Benzene (mg/L) in LSZ

- Benzene at LSZ54 above 5 µg/L (currently validating)
- Decreasing benzene concentrations in some treatment areas (LSZ38, LSZ39, W37)

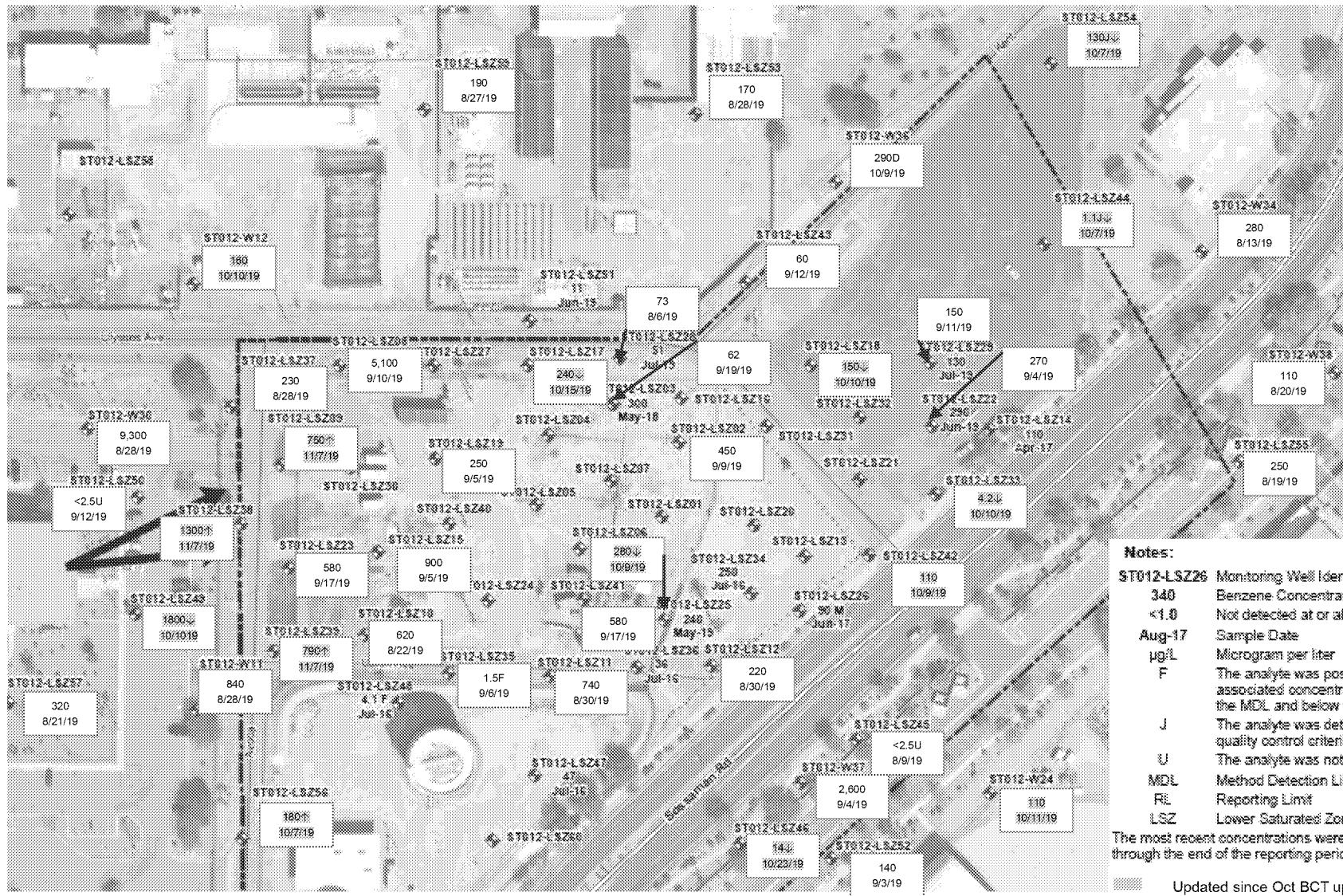


Notes:

- ST012-LSZ26 Monitoring Well Identification**
340 Benzene Concentration (µg/L)
<1.0 Not detected at or above the RL
Aug-17 Sample Date
µg/L Microgram per liter
F The analyte was positively identified but the associated concentration is an estimation above the MDL and below the RL
J The analyte was detected, estimated due to quality control criteria
U The analyte was not detected above the RL
MDL Method Detection Limit
RL Reporting Limit
LSZ Lower Saturated Zone
- The most recent concentrations were used at a given location through the end of the reporting period.
- Updated since Oct BCT update (arrow indicates direction of change from previous result)



Site ST012 Sulfate (mg/L) in LSZ



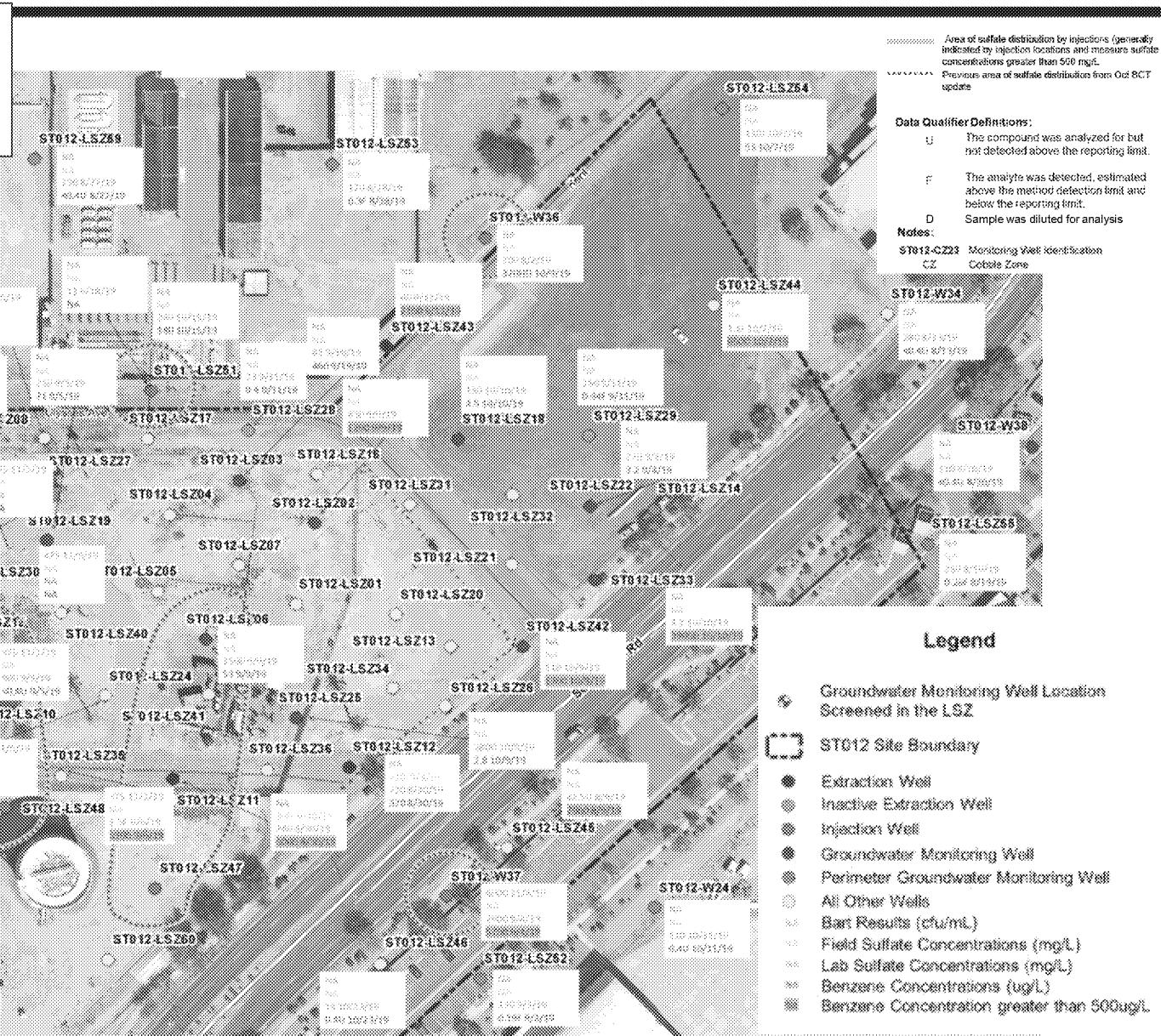
Notes:

- ST012-LSZ26 Monitoring Well Identification
 - 340 Benzene Concentration ($\mu\text{g/L}$)
 - <1.0 Not detected at or above the RL
 - Aug-17 Sample Date
 - $\mu\text{g/L}$ Microgram per liter
 - F The analyte was positively identified but the associated concentration is an estimation above the MDL and below the RL
 - J The analyte was detected; estimated due to quality control criteria
 - U The analyte was not detected above the RL
 - MDL Method Detection Limit
 - RL Reporting Limit
 - LSZ Lower Saturated Zone
- The most recent concentrations were used at a given location through the end of the reporting period.
- Updated since Oct BCT update (arrow indicates direction of change from previous result)



EBR Treatment Areas in LSZ

- LSZ10 and LSZ42 previously tested for degrader populations by qPCR
- Recently conducted screening test (BART) in several locations (LSZ09, LSZ10, LSZ15, LSZ23, LSZ24, LSZ27, LSZ30, LSZ35, LSZ38, LSZ39, LSZ40).





Site ST012 Potential Biological Testing Locations

- Evaluated well locations for potential biological testing
- Indicators of a good location
 - Sulfate distribution above background
 - Field parameters (neutral pH, low dissolved oxygen, negative ORP)
 - Positive BART test kit result
 - Possible benzene reduction
 - Possible sulfate consumption
- Four potential locations identified
 - UWBZ26
 - LSZ38
 - LSZ39
 - W37



Site ST012 Potential Biological Testing Location UWBZ26

Extraction Well Status	Sample Date	Days to Reaction	Approximate SRB Population (cfu/mL)	UWBZ26											
				TPH-DRO mg/L	TPH-GRO mg/L	Benzene ug/L	Ethylbenzene ug/L	Nitrogen, nitrate mg/L	Sulfate (Lab) mg/L	Sulfate (Field) mg/L	Temperature (Field) °F	pH (Field)	Conductivity (Field) µS/cm	DO (Field) mg/L	ORP (Field) mV
Pumping	2/12/2019	NA	NA	NA	NA	2900	J	940	J	NA	NA	NA	NA	NA	NA
Pumping	6/14/2019	NA	NA	6.6	J	24	J	2100	M	960	M	< 1.0	U	220	NA
Pumping	6/14/2019	NA	NA	22	J	29	J	2100	M	900	M	< 1.0	U	220	NA
Offline	8/29/2019	NA	NA	6.4	J	14	J	3800	J	1400	J	0.2	U	990	NA
Offline	9/3/2019	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	710	NA	NA	NA
Offline	9/6/2019	4	27,000	NA	NA	710	J	190	J	NA	NA	NA	NA	NA	NA
Offline	9/10/2019	NA	NA	NA	NA	NA	NA	NA	NA	0.5	U	740	810	NA	NA
Offline	11/5/2019	No Reaction	<75	NA	NA	NA	NA	NA	NA	NA	NA	94.1	6.84	5978	0.38

Notes:

- F, J – The analyte was positively identified but the quantitation is an estimation
- M – Manually integrated compound
- U – Not detected. Reporting limit listed
- NA - Not Analyzed

- **Former extraction well**
- **Indicators of a good location**
 - Sulfate distribution above background -yes
 - Field parameters (neutral pH, low dissolved oxygen, negative ORP)-yes
 - Positive BART test kit result-yes, but not sustained
 - Possible benzene reduction-yes
 - Possible sulfate consumption-uncertain (no recent results to correspond to latest BART result)
- **Recommendations**
 - Check sulfate concentration. Recheck BART upon confirmation of restored sulfate concentrations.
 - Deploy BioTraps if BART result returns to previous range



Site ST012 Potential Biological Testing Location LSZ38

Extraction Well Status	Sample Date	Days to Reaction	Approximate SRB Population (cfu/mL)	LSZ38											
				TPH-DRO mg/L	TPH-GRO mg/L	Benzene ug/L	Ethylbenzene ug/L	Nitrogen, nitrate mg/L	Sulfate mg/L	Sulfate (Field) mg/L	Temperature (Field) °F	pH (Field)	Conductivity (Field) µS/cm	DO (Field) mg/L	ORP (Field) mV
Pumping	2/12/2019	NA	NA	NA	NA	2100	75	F	NA	NA	NA	NA	NA	NA	NA
Pumping	6/14/2019	NA	NA	1.2	6.8	2200	180		3.1	98	NA	NA	NA	NA	NA
Offline	8/28/2019	NA	NA	.81	3.6	1800	220		65	1000	NA	NA	NA	NA	NA
Offline	9/3/2019	NA	NA	NA	NA	NA	NA		NA	NA	1000	NA	NA	NA	NA
Offline	9/6/2019	2	500,000	NA	NA	690	140		NA	1100	NA	NA	NA	NA	NA
Offline	9/10/2019	NA	NA	NA	NA	NA	NA		NA	980	NA	NA	NA	NA	NA
Offline	9/17/2019	NA	NA	NA	NA	NA	NA		NA	1200	NA	NA	NA	NA	NA
Offline	11/1/2019	8	75	NA	NA	NA	NA		NA	NA	80.64	7.51	5580	2	-247.3

Notes:

F, J – The analyte was positively identified but the quantitation is an estimation
M – Manually integrated compound
U – Not detected. Reporting limit listed
NA - Not Analyzed

- **Former extraction well**
- **Indicators of a good location**
 - Sulfate distribution above background -yes
 - Field parameters (neutral pH, low dissolved oxygen, negative ORP)-yes
 - Positive BART test kit result-yes, but not sustained
 - Possible benzene reduction-yes
 - Possible sulfate consumption-uncertain (no recent results to correspond to latest BART result)
- **Recommendations**
 - Check sulfate concentration. Recheck BART upon confirmation of restored sulfate concentrations.
 - Deploy BioTraps if BART result returns to previous range



Site ST012 Potential Biological Testing Location LSZ39

Extraction Well Status	Sample Date	Days to Reaction	Approximate SRB Population (cfu/mL)	LSZ39											
				TPH-DRO mg/L	TPH-GRO mg/L	Benzene ug/L	Ethylbenzene ug/L	Nitrogen, nitrate mg/L	Sulfate mg/L	Sulfate (Field) mg/L	Temperature (Field) °F	pH (Field)	Conductivity (Field) µS/cm	DO (Field) mg/L	ORP (Field) mV
Pumping	2/12/2019	NA	NA	NA	NA	130	J	7.5	F	NA	NA	NA	NA	NA	NA
Offline	6/17/2019	NA	NA	1.9	12	4200	J	530	< 1.0	U	720	NA	NA	NA	NA
Offline	6/17/2019	NA	NA	2.5	15	4500	J	580	< 1.0	U	720	NA	NA	NA	NA
Offline	6/17/2019	4	27,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Offline	7/9/2019	NA	NA	NA	NA	NA	NA	NA	NA	NA	1220	NA	NA	NA	NA
Offline	8/6/2019	NA	NA	NA	NA	NA	NA	NA	NA	NA	1200	NA	NA	NA	NA
Offline	8/28/2019	NA	NA	1.5	7.7	3100	J	630	0.14	U	420	NA	NA	NA	NA
Offline	10/22/2019	NA	NA	NA	1.1	1400	J	350	0.2	U	NA	NA	NA	NA	NA
Offline	11/1/2019	10	<75	NA	NA	NA	NA	NA	NA	NA	NA	85.09	7.2	7527	0.7
															-82.7

Notes:
 F, J – The analyte was positively identified but the quantitation is an estimation
 M – Manually integrated compound
 U – Not detected. Reporting limit listed
 NA – Not Analyzed

- **Former extraction well**
- **Data above in red is preliminary**
- **Indicators of a good location**
 - Sulfate distribution above background -yes
 - Field parameters (neutral pH, low dissolved oxygen, negative ORP)-yes
 - Positive BART test kit result-yes, but not sustained
 - Possible benzene reduction-yes
 - Possible sulfate consumption-yes
- **Recommendations**
 - Check sulfate concentration. Recheck BART upon confirmation of restored sulfate concentrations.
 - Deploy BioTraps if BART result returns to previous range



Site ST012 Potential Biological Testing Location W37

Extraction Well Status	Sample Date	Days to Reaction	Approximate SRB Population		TPH-DRO	TPH-GRO	Benzene	Ethylbenzene	Nitrogen, nitrate	Sulfate (Lab)	Sulfate (Field)	Temperature (Field)	pH (Field)	Conductivity (Field)	DO (Field)	ORP (Field)	
			(cfu/mL)	mg/L	mg/L	ug/L	ug/L	mg/L	mg/L	mg/L	mg/L	°F	µS/cm	mg/L	mV		
Not applicable	3/8/2017	NA	NA	4.4	53	12000	1200	0.5	U	5	U	NA	80.5	6.32	4100	0.68	-35.4
Not applicable	7/21/2017	NA	NA	0.77	29	11000	460	NA	NA	NA	NA	83.01	6.82	2116	0.5	55	
Not applicable	11/10/2017	NA	NA	1.3	32	12000	970	NA	NA	NA	NA	82.46	6.85	3901	5.14	-21.8	
Not applicable	11/16/2018	NA	NA	24	47	10000	1400	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Not applicable	3/22/2019	NA	NA	24	47	2300	1400	NA	NA	190	NA	NA	NA	NA	NA	NA	
Not applicable	7/1/2019	NA	NA	0.54	8.5	3800	100	2.5	U	5600	NA	NA	NA	NA	NA	NA	
Not applicable	9/4/2019	NA	NA	NA	NA	5700	670	0.5	U	2600	NA	NA	NA	NA	NA	NA	
Not applicable	11/4/2019	5	6000	NA	NA	NA	NA	NA	NA	NA	NA	77.59	6.86	4076	1.92	-274.7	

Notes:
F, J – The analyte was positively identified but the quantitation is an estimation
M – Manually integrated compound
U – Not detected. Reporting limit listed
NA - Not Analyzed

- Current injection well

- Indicators of a good location

- Sulfate distribution above background -yes
- Field parameters (neutral pH, low dissolved oxygen, negative ORP)-yes
- Positive BART test kit result-yes
- Possible benzene reduction-yes
- Possible sulfate consumption-yes

- Recommendations

- Complete injections at W37 and monitor sulfate drop until around 1,000 mg/L
- Collect BART test to confirm SRB presence
- Deploy BioTraps



Pilot Study Injection/Extraction Update

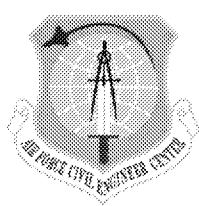


Site ST012 Extraction System Performance

Extraction Well	Calculated Average Extraction Rate in Period gpm	Maximum Temperature °F	Most Recent Temperature °F	Cumulative Extraction gallons	Note
ST012-CZ07	6.5	175	142	4,015,680	
ST012-CZ18	Off	136	126	3,019,867	Extraction stopped due to sulfate presence (Oct 2019)
ST012-CZ19	NA				Eliminated as an extraction well by FVM#7
ST012-CZ21	0.3	150	110	452,498	Totalizer reading suspect
ST012-CZ23	2.4	101	100	379,433	
CZ Subtotal				7,867,479	
ST012-UWBZ21		162	105	591,514	Pneumatic pump, currently down
ST012-UWBZ22	0.2	146	120	459,240	Totalizer reading suspect
ST012-UWBZ25	5.8	168	168	199,490	
ST012-UWBZ26	Off	133	114	2,408,709	Extraction stopped due to sulfate presence (Sep 2019)
ST012-UWBZ27	Off	128	94	130,009	Extraction stopped due to sulfate presence (May 2019)
ST012-UWBZ30		172	65	1,397,243	Pneumatic pump, pumping intermittently, counter suspect
UWBZ Subtotal*				6,454,638	
ST012-LSZ09	Off	140	130	2,748,461	Extraction stopped due to sulfate presence (Oct 2019)
ST012-LSZ11	12.8	139	94	4,129,107	Flow meter troubleshooting
ST012-LSZ12	0.9	130	78	1,809,111	Pump down, electrical issue
ST012-LSZ23	Off	113	94	3,638,934	Extraction stopped due to sulfate presence (Aug 2019)
ST012-LSZ28	NA	162		18,899	Eliminated as an extraction well by FVM#7
ST012-LSZ29	NA	>170		17	Eliminated as an extraction well by FVM#7
ST012-LSZ37	11.6	132	90	6,274,757	Extraction stopped due to sulfate presence (Oct 2019)
ST012-LSZ38	Off	160	90	941,898	Extraction stopped due to sulfate presence (Aug 2019)
ST012-LSZ39	Off	92	78	1,250,933	Extraction stopped due to sulfate presence (May 2019)
ST012-LSZ43	3.5	140	121	441,689	
ST012-UWBZ28/LSZ51		146	128	2,536,868	Extraction stopped (Aug 2019), changed to injection end of subphase 2
LSZ Subtotal*				22,522,241	
Total of Wells	44.1			36,844,357	
Treatment System	36.4			27,095,990	

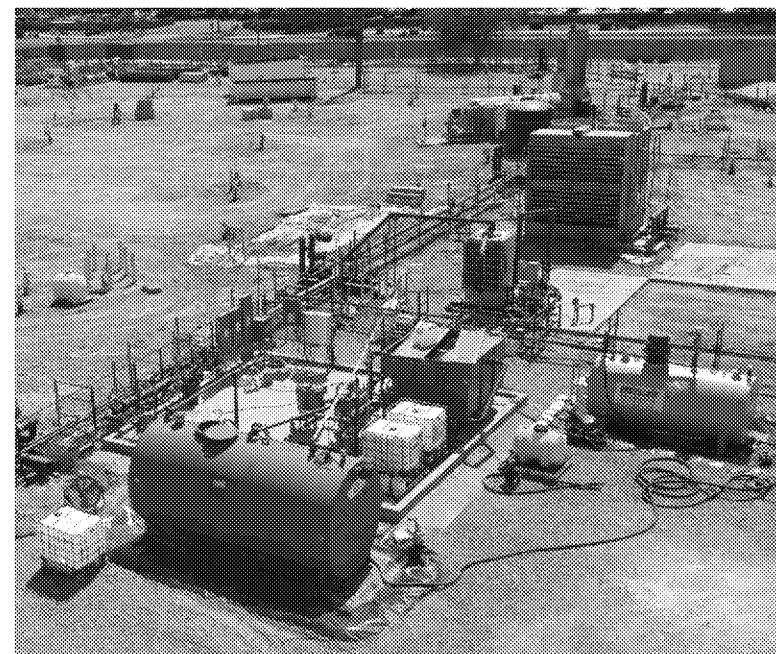
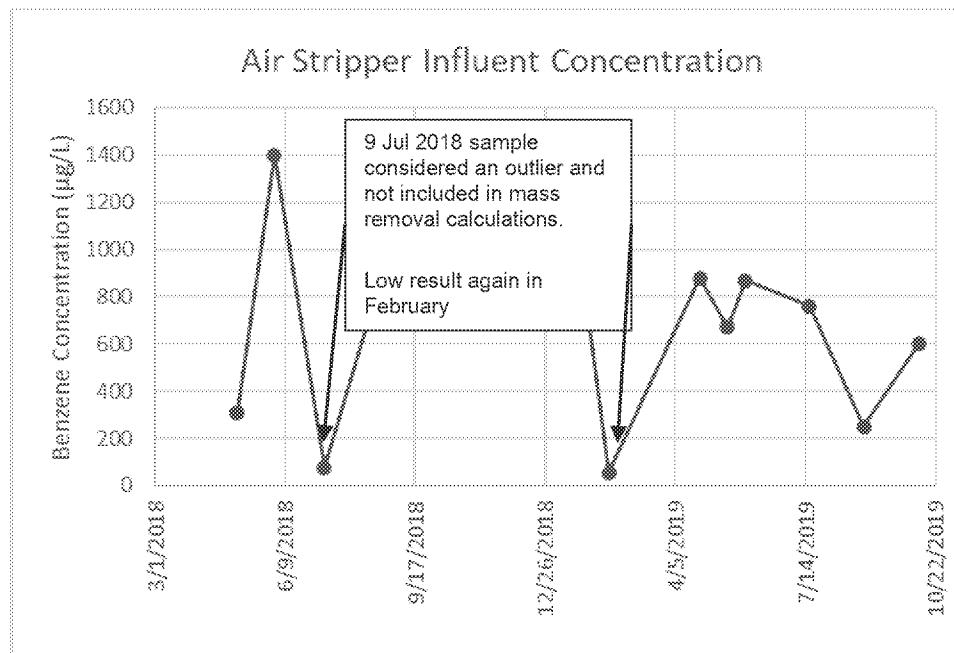
Data is preliminary

* Includes 1/2 of ST012-UWBZ28/LSZ51



Site ST012 Extraction System Performance

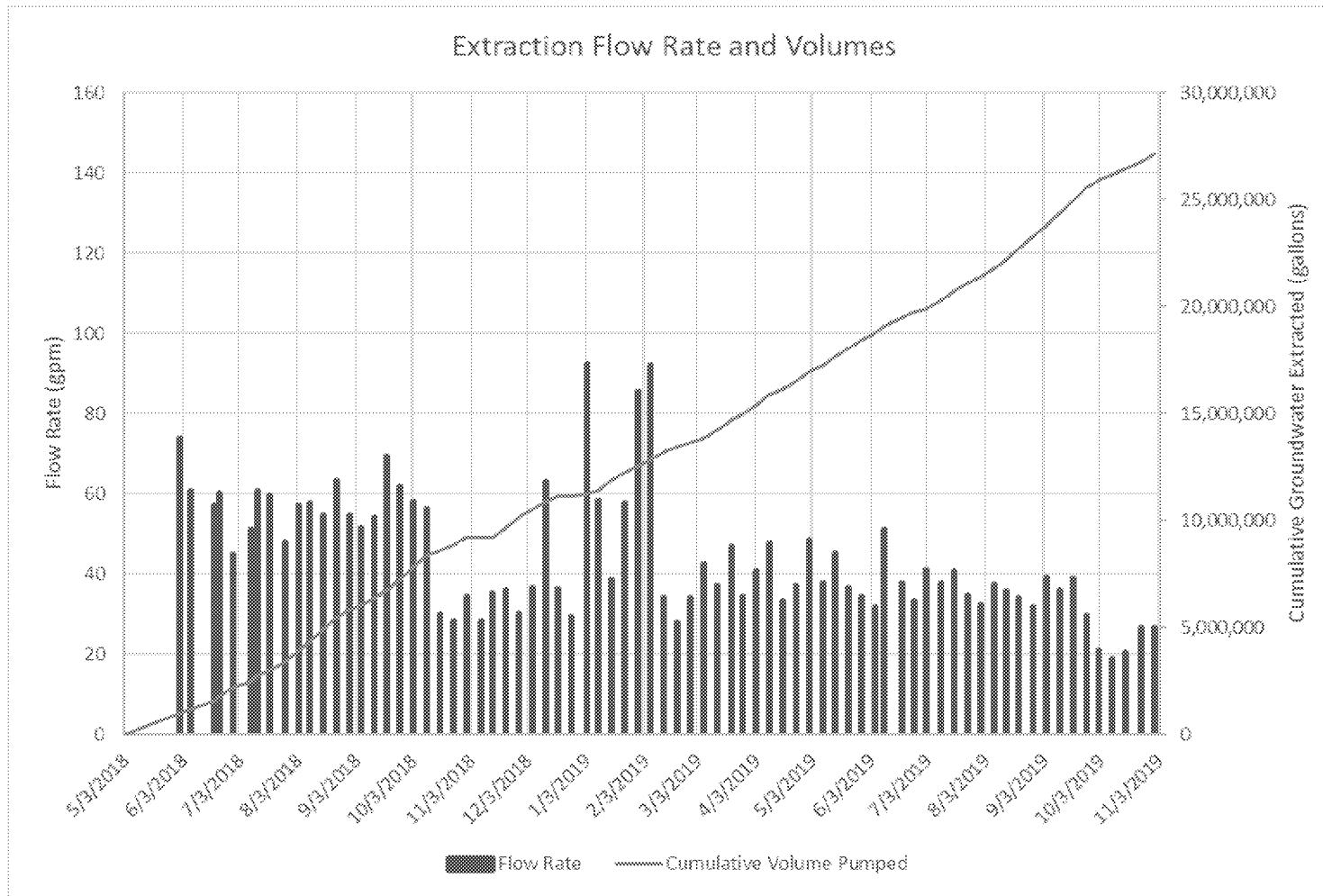
- No LNAPL has been recovered since extraction started up
- All extraction pumps except LSZ12 working
- Extraction at CZ18, UWBZ21, UWBZ26, UWBZ27, LSZ09, LSZ23, LSZ38, and LSZ39 turned off due to sulfate distribution
- Benzene air stripper influent at 600 µg/L for October sample





Site ST012 Extraction System Performance

- Overall Extraction Rates and Cumulative Volume Extracted

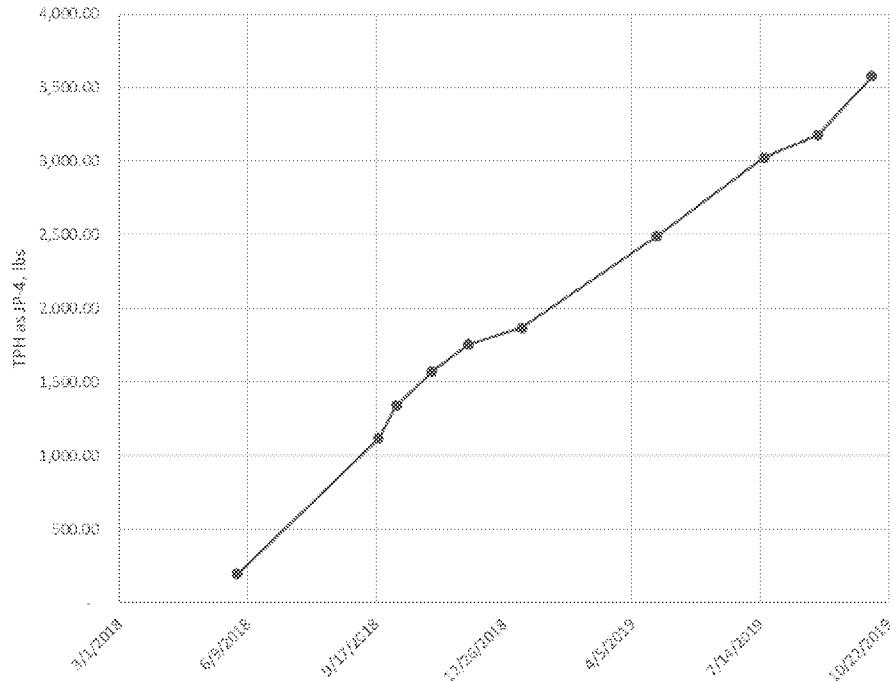




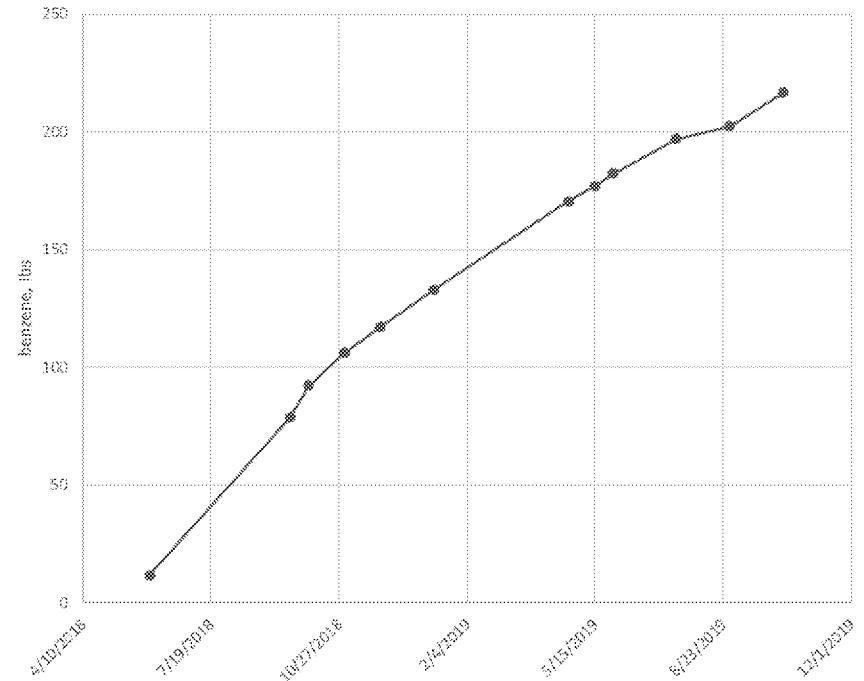
Site ST012 Extraction System Performance

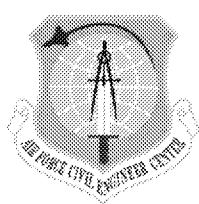
- Estimated Mass Removal by Extraction

Total TPH as JP-4 extracted



Total benzene extracted

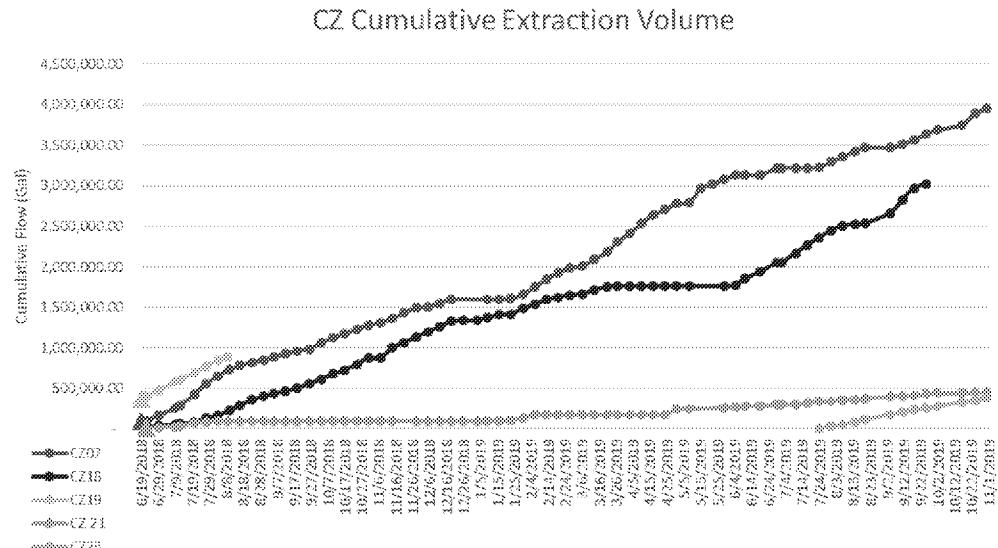




Cumulative Extraction Volume and Analytical Data by Well - Cobble Zone

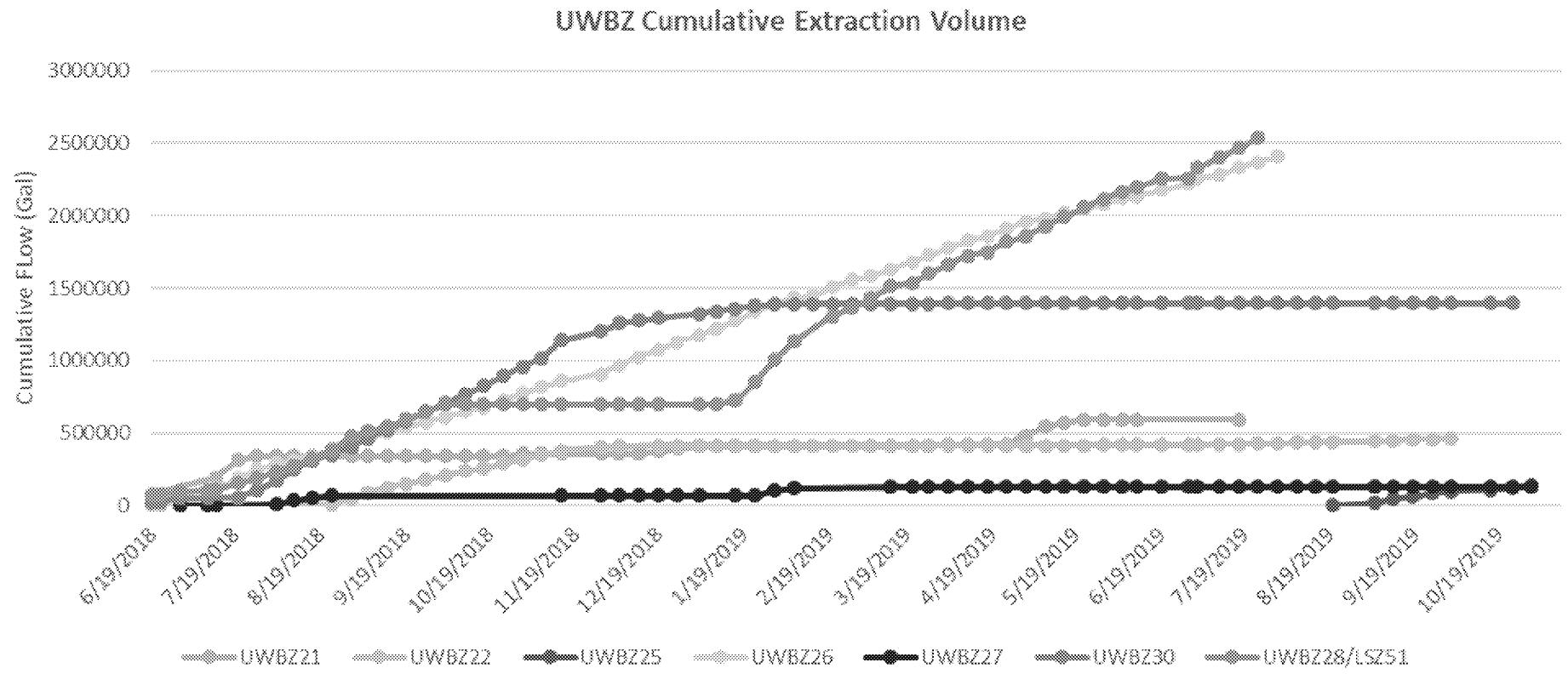
Well ID	Date Sampled	Benzene Concentration, µg/L
ST012-CZ07 (Start May 2018)	4/30/2018	230
	11/1/2018	600
	2/11/2019	410
	6/18/2019	320
	9/11/2019	610
	10/24/2019	270
ST012-CZ18 (Start May 2018 Stop Oct 2019)	4/3/2018	1200
	11/1/2018	260
	2/11/2019	260
	6/14/2019	140
	8/29/2019	170
	10/17/2019	120
ST012-CZ19 (Start May 2018 Stop Aug 2018)	5/9/2018	3.1
	6/24/2019	160
	8/29/2019	140
ST012-CZ21 (Start June 2018)	4/12/2018	680
	6/17/2019	91
	8/30/2019	82
ST012-CZ23 (Start Jul 2019)	7/12/2019	4.3
	9/18/2019	1.9

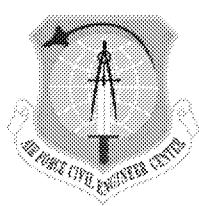
- Most recent baseline and operating (when available) benzene analytical result listed (Oct 2019 added)





Cumulative Extraction Volume by Well - Upper Water Bearing Zone



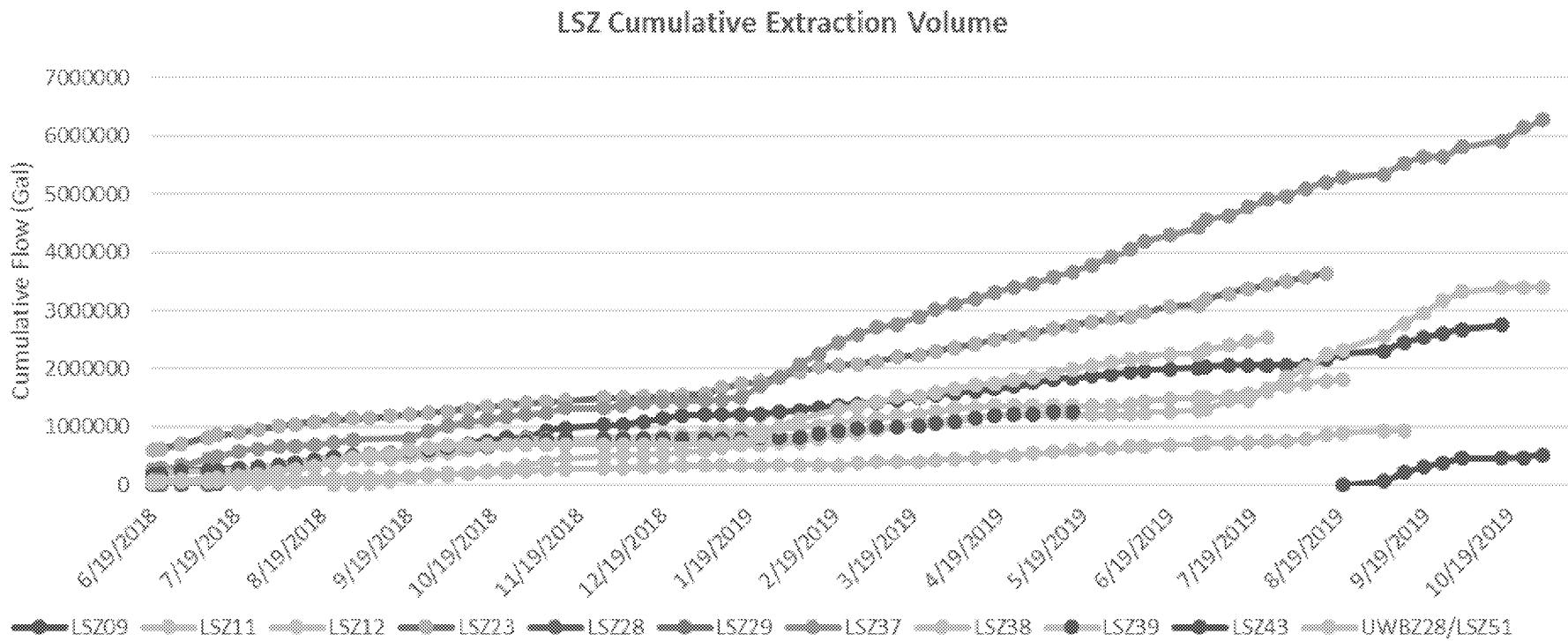


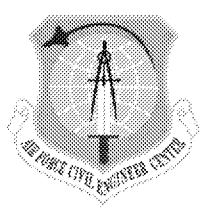
Analytical Data by Extraction Well - Upper Water Bearing Zone

Well ID	Date Sampled	Benzene Concentration, µg/L
ST012-UWBZ21 (Start Jun 2018)	8/9/2017	3400
	5/22/2019	570
ST012-UWBZ22 (Start Jun 2018)	5/9/2018	1900
	2/11/2019	2800
	7/11/2019	2300
	8/29/2019	3300
	10/24/2019	3500
	4/3/2018	3500
ST012-UWBZ26 (Start May 2018 Stop Sep 2019)	4/3/2018	3700
	2/12/2019	2900
	6/14/2019	2100
	8/29/2019	3800
	9/6/2019	710
	4/3/2018	1500
ST012-UWBZ27 (Start May 2018 Stop May 2019)	2/12/2019	460
	6/14/2019	350
	8/29/2019	640/570
	5/9/2018	1700
ST012-UWBZ28/LSZ51 (Start May 2018 Stop Aug 2019)	3/25/2019	650
	5/9/2018	6000
	2/13/2019	21
	6/14/2019	840
	9/9/2019	23



Cumulative Extraction Volume by Well Lower Saturated Zone





Analytical Data by Extraction Well

Lower Saturated Zone

Well ID	Date Sampled	Benzene Concentration, µg/L
ST012-LSZ09 (Start May 2018 Stop Oct 2019)	4/3/2018	2100
	2/12/2019	1000
	6/14/2019	630D
	8/28/2019	1300
	10/17/2019	760
ST012-LSZ11 (Start Jun 2018)	5/9/2018	2100
	2/12/2019	3500
	6/18/2019	4800 (D)
	8/30/2019	5900/6000
ST012-LSZ12 (Start Jun 2018)	5/9/2018	1400
	11/1/2018	420
	2/12/2019	470
	6/19/2019	220
	8/30/2019	370
ST012-LSZ23 (Start May 2018 Stop Aug 2019)	4/3/2018	1600
	2/12/2019	790
	6/14/2019	950
	8/28/2019	160
	9/6/2019	440
ST012-LSZ37 (Start May 2018 Stop Oct 2019)	4/12/2018	2700
	2/12/2019	460
	6/14/2019	540
	8/28/2019	730
ST012-LSZ38 (Start May 2018 Stop Aug 2018)	4/3/2018	3000
	11/1/2018	1300
	2/12/2019	2100
	6/14/2019	2200
	8/28/2019	1800
	9/6/2019	690



Analytical Data by Extraction Well Lower Saturated Zone (Cont.)

Well ID	Date Sampled	Benzene Concentration, µg/L
ST012-LSZ39 (Start May 2018 Stop May 2019)	2/12/2019	130
	6/17/2019	4500
	8/28/2019	3100
ST012-LSZ43 (Start Aug 2019)	5/24/2019	320
	9/12/2019	2100
ST012-UWBZ28/LSZ51 (Start May 2018 Stop Aug 2019)	5/9/2018	1700
	3/25/2019	650



Site ST012 Injection Progress

- Injections continued in October**
- 372 tons injected through 30 Oct 2019**
- 51.15 tons injected since last update**
- Subphase 3 injections ongoing and will continue through Dec**

Date	Volume (gallons)	Number of Bags of Sulfate Added	Calculated Na2SO4 Conc. g/L	Calculated SO4 Conc. g/L	Locations(% of volume if multiple locations)
10/8/2019	8000	4	113	76	UWBZ35 (1.0 tons) UWBZ34 (2.3 tons)
10/9/2019	8000	4	113	76	UWBZ35 (3.1 tons) UWBZ34 (3.8 tons)
10/9/2019	8000	4	113	76	
10/10/2019	8000	4	113	76	UWBZ35 (1.3 tons) UWBZ34 (2.0 tons)
10/11/2019	4000	2	113	76	UWBZ35 (0.6 tons) UWBZ34 (0.9 tons)
10/14/2019	6000	3	113	76	UWBZ33 (3.5 tons)
10/16/2019	8000	4	113	76	UWBZ33 (1.9 tons) UWBZ35 (0.7 tons) UWBZ34 (1.5 tons)
10/18/2019	8000	4	113	76	UWBZ33 (1.9 tons) UWBZ35 (0.8 tons) UWBZ34 (0.9 tons)
10/21/2019	8000	4	113	76	UWBZ33 (1.1 tons) UWBZ35 (1.5 tons) UWBZ34 (0.1 tons)
10/22/2019	8000	4	113	76	UWBZ33 (0.8 tons) UWBZ35 (0.7 tons) UWBZ34 (1.2 tons)
10/22/2019	8000	4	113	76	
10/23/2019	8000	4	113	76	UWBZ33 (2.7 tons) UWBZ35 (0.7 tons) UWBZ34 (0.8 tons)
10/23/2019	8000	4	113	76	
10/24/2019	8000	4	113	76	UWBZ33 (2.0 tons) UWBZ35 (0.3 tons) UWBZ34 (1.7 tons)
10/24/2019	8000	4	113	76	
10/25/2019	8000	4	113	76	UWBZ33 (0.4 tons) UWBZ35 (1.0 tons) UWBZ34 (0.2 tons)
10/28/2019	6000	3	113	76	UWBZ33 (1.3 tons) UWBZ35 (0.5 tons) UWBZ34 (1.0 tons)
10/29/2019	8000	4	113	76	UWBZ33 (1.1 tons) UWBZ35 (1.5 tons) UWBZ34 (1.4 tons)
10/30/2019	8000	4	113	76	UWBZ33 (2.0 tons) UWBZ35 (0.4 tons) UWBZ34 (1.7 tons)



Site ST012 Path Forward Nov-Dec

- Continue SVE operation
- Continue pump repairs
- Pilot Study Implementation
 - Continue mixing sulfate batches and inject according to plan (FVM7) Phase 1 subphase 3 injections with the modifications previously presented
 - Resample to confirm benzene at LSZ54 and then evaluate response
 - Reduce sampling frequency at CZ23 to quarterly
 - Prepare to deploy BioTraps® per recommendations on earlier slides

Air Force Civil Engineer Center



**2019 BCT
MEETINGS/CONFERENCE
CALLS SCHEDULE
DELIVERABLE TRACKING**

**BCT Conference Call
21 November 2019**

Air Force Civil Engineer Center



BCT GENERAL UPDATE AND ACTION ITEMS

BCT Conference Call
21 November 2019